**Calculation Example for Newton’s Law of Cooling: Calculating ‘k”**

Name : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Newton's Law of Cooling** states that the rate of change of the temperature of an object is proportional to the difference between its own temperature and the ambient temperature (i.e. the temperature of its surroundings).



Where t is the elapsed time  
T(t) is the temperature of the given body at time t,  
Ts is the surrounding temperature,  
To is the initial temperature of the body,  
k is the constant  
kt = the constant times the length of cooling time

source: <https://www.youtube.com/watch?v=zi3kqYH9F9w>

A few pointers before you begin:

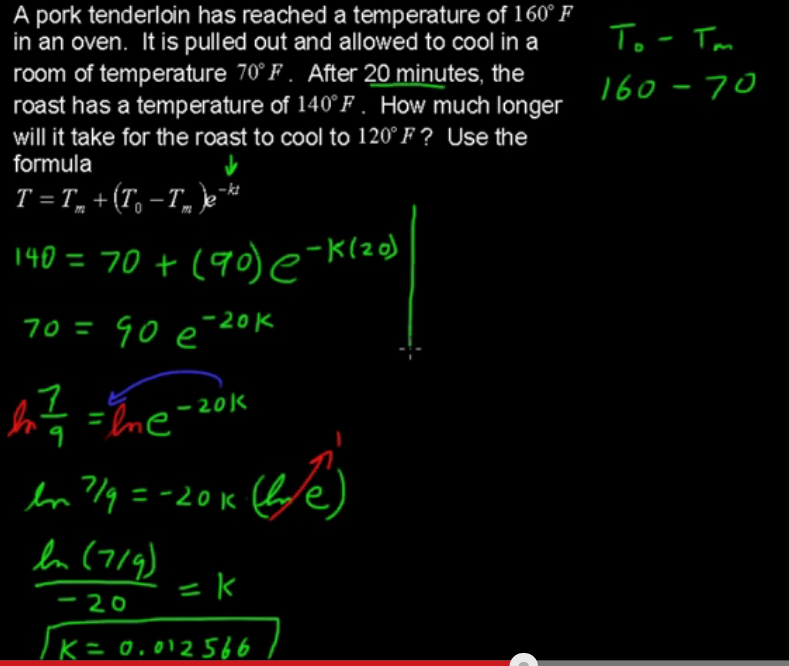
A logarithm is a mathematical function which describes all numbers as powers of ten by using the exponent of that power: for example, the log of 100 is 2 because, 100 = 10^2. In this fashion, before computers, all numbers could be expressed as either whole number values of the power of ten or decimals. In a similar fashion. The log of 10 is 1 and the log of 5 is 0.69897; that means if we could raise 10 to the 0.69897 power, we would get 5.

A second system of logarithms exists which are called “natural logs” abbreviated on your calculator as “ln” This system was invented to better express growth or decay rates which are exponential. Rather than being based on a power of 10, it is based on the number 2.178 For our purposes, you need only know that the natural lob may be accessed on your calculator.

So how does all this relate to cooling?

Watch the video link below and follow the directions:

source: <https://www.youtube.com/watch?v=zi3kqYH9F9w>



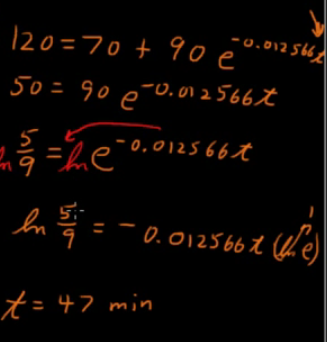
T**m** = ambient temperature (room temperature)

T**o** = starting temperature of object

C = natural log (ln)

Solution for “k” in the problem above: k = 0.012566

The author of this video first calculates “k” using the numbers stated in the problem. He then calculates the answer to the original question how long would it take the roast to cool to a specific temperature by using “k” in the formula at the top of the page:

 You may now practice this method by using your data to find out how long it would take your potato to cool to room temperature.

Mr. Richardson will be making an appearance to assist us in this quest.

Use the blank space provided on this handout to show your work.